



# Connected (!) and Automated Shuttle Project

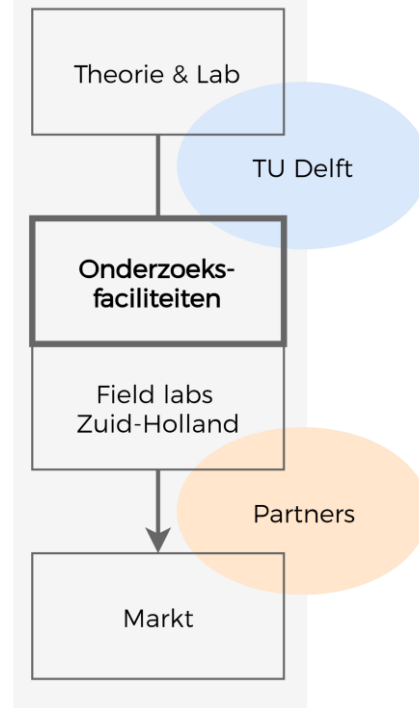
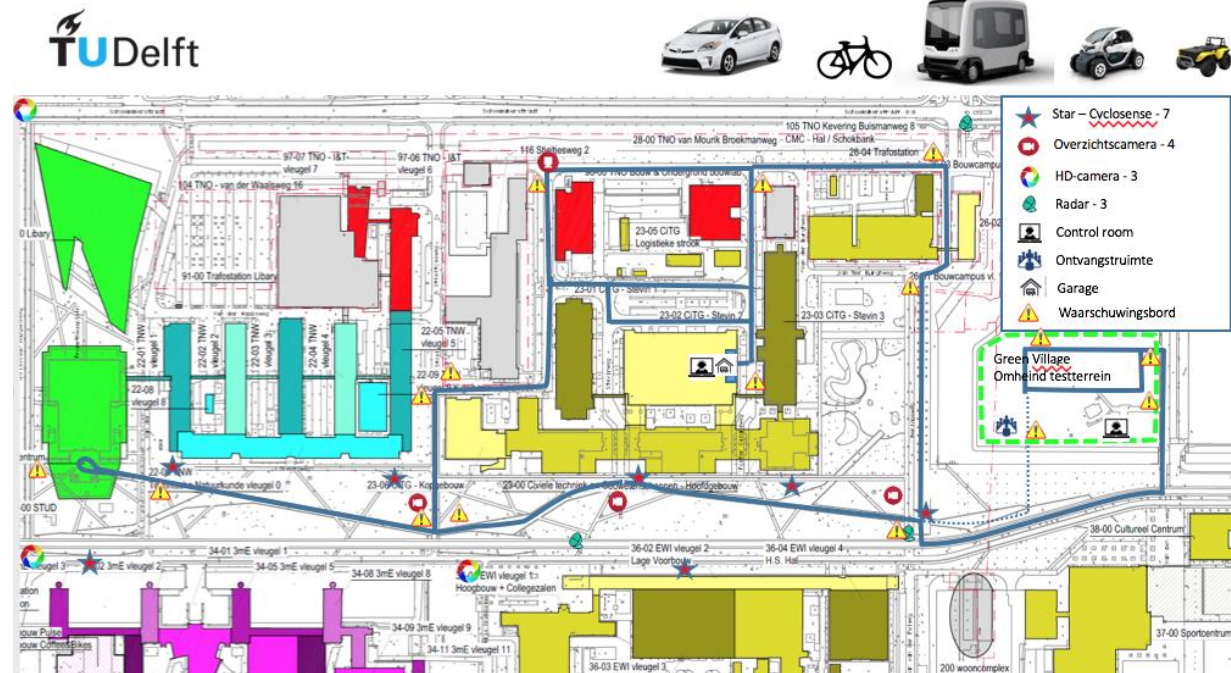
Robert Boshouwers (DAM)  
Joop Veenis (DAM)

2020

Dutch Automated Mobility (DAM)  
ESA NAVISP Industry days

# Future Mobility located in Delft

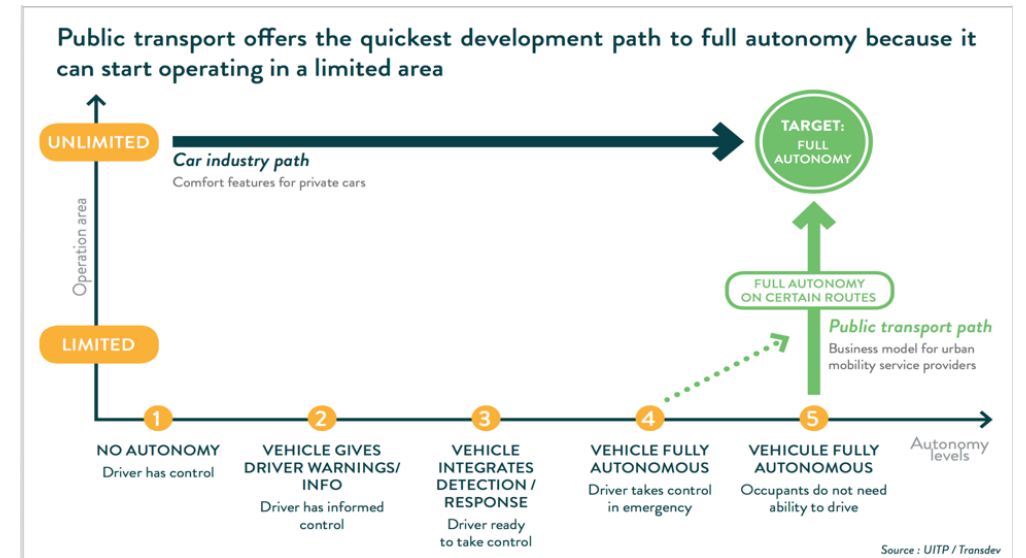
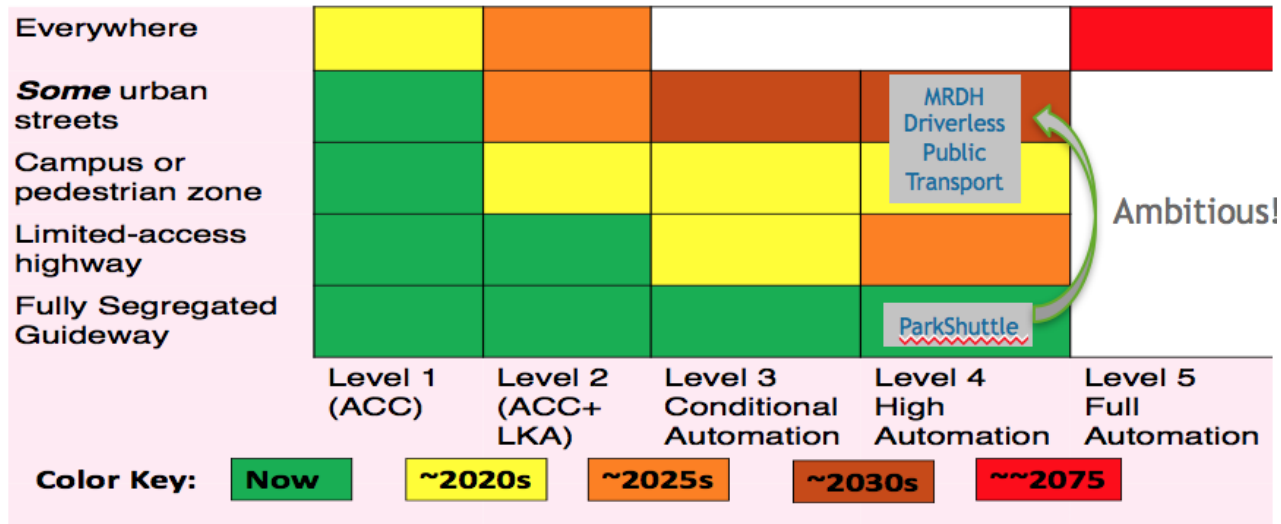
- Research labs and a central knowledge hub for several Fieldlabs in the Netherlands for Smart Mobility, Smart Logistics, Smart Shipping and Spatial Strategy



# Time line to full automation (SAE-5), is based on ODD

## Time-table

[Opinions collected at AUVSI 2016]



# Usecase HagaShuttle Last Mile Public Transport



Haags openbaar vervoer wordt aangevuld met zelfrijdende minibus

17 januari 2019 10:08

Laatste update: 17 januari 2019 11:31



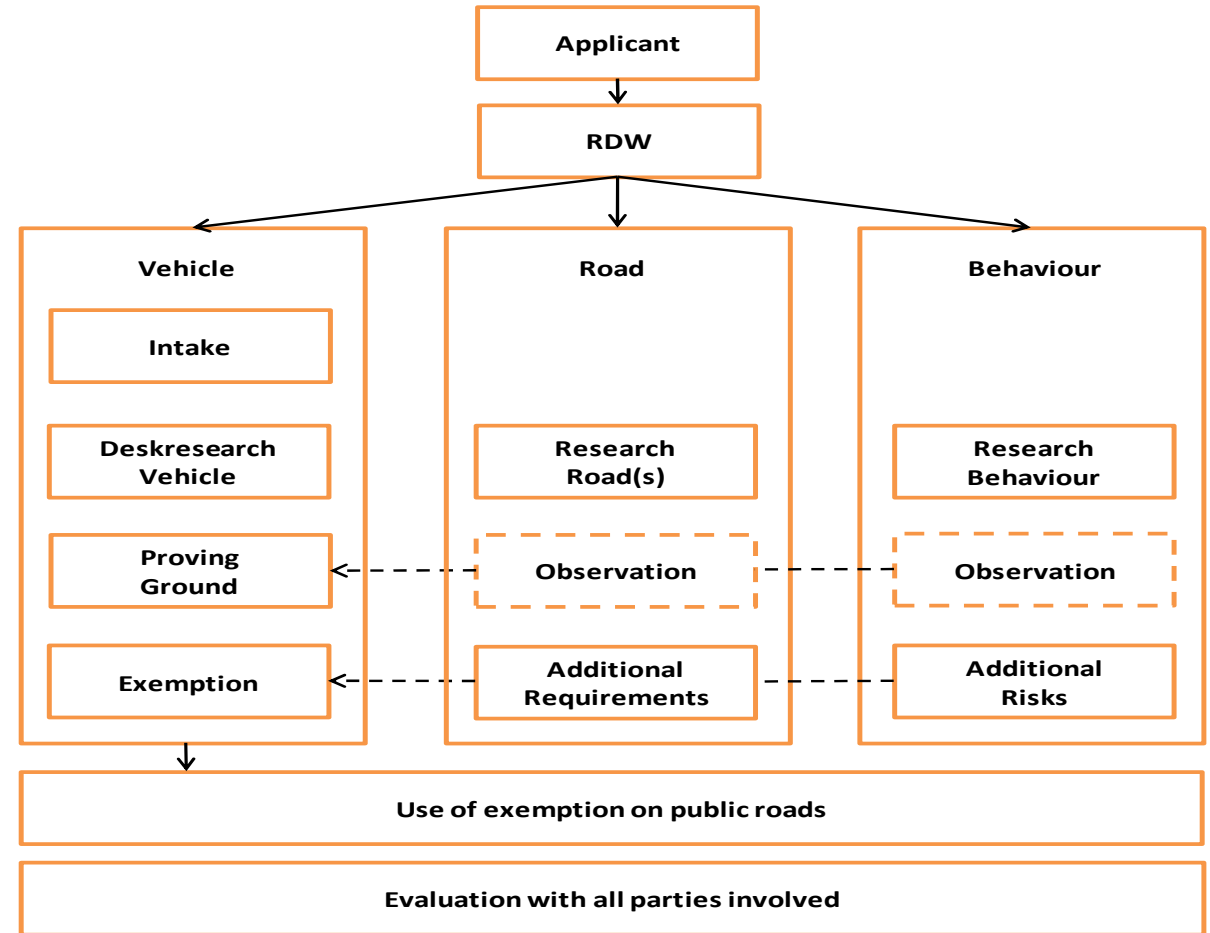
**Aanvullend op het openbaar vervoer gaat er vanaf medio dit jaar een zelfrijdende minibus in Den Haag de weg op. Een woordvoerder van vervoermaatschappij HTM meldt dat het de eerste zelfrijdende minibus is die in een van de vier grote steden (Den Haag, Amsterdam, Utrecht en Rotterdam) in gebruik wordt genomen.**

Bezoekers en patiënten van het HagaZiekenhuis kunnen met de zelfrijdende minibus gratis de laatste paar honderd meter van de halte van het openbaar vervoer naar de ingang van het ziekenhuis afleggen.



# Legal Framework NL on Public Roads (RDW)

1. Exemption Law [2016-2018...]
2. Experimental Law [2019..]



# Vehicle Technology Maturity

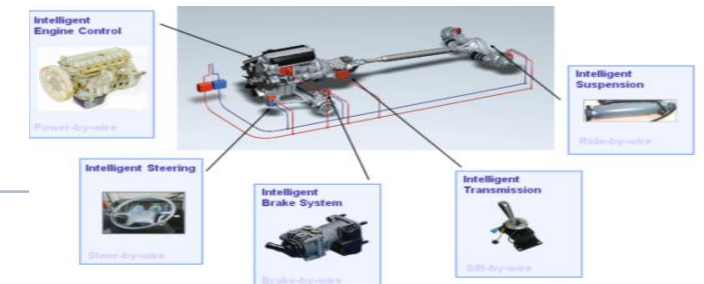
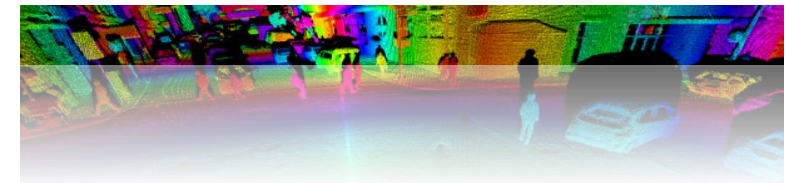
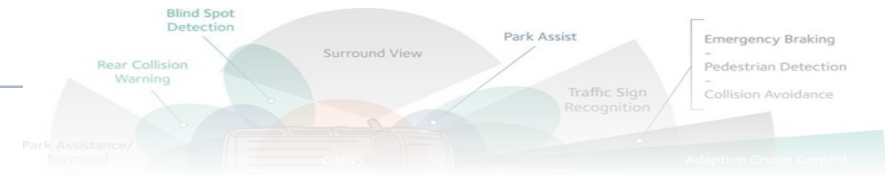
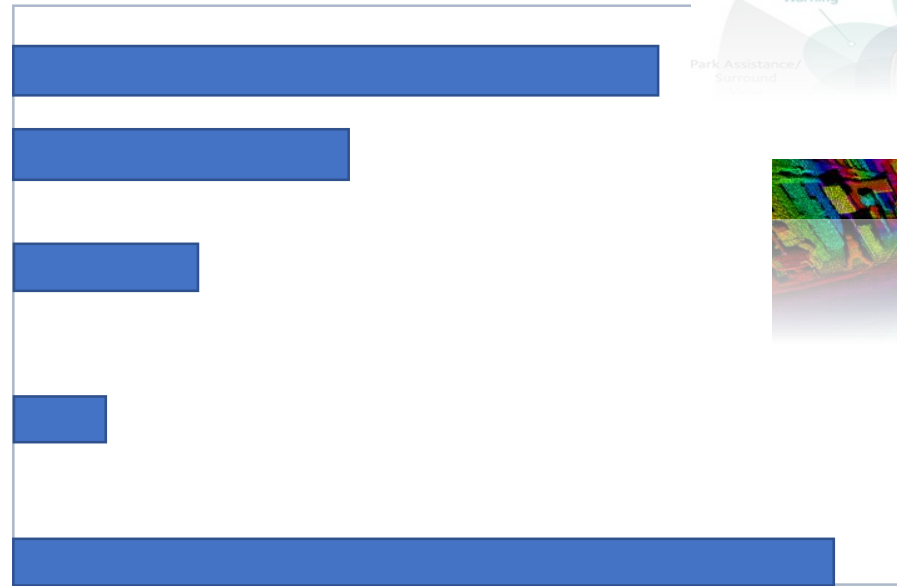
Route

Detect

Perception

Respond

Actuate



# Vehicle technology perception test at RADD



# ESA ESTEC Timeline so far

- Preparations started in 2018
- Project plan
- Health & Safety Plan
- Dutch Automated Mobility and Arriva
- Grant by province Zuid-Holland and (co)financing by ESA ESTEC
- Ordering shuttle from Navya
- Commissioning and testing on-site
- Stewards (training and practice)
- October 29th: ORBITER in operation



# 2019: Welcome on board the ORBITER



# 2020: Welcome on board the HAWKING!



HARA



## Principles and goals:

- ✓ Our aim is to have a vehicle (HAWKING) that **does not collide with anything**; with passengers on board, but no steward in the vehicle but with remote supervision for interventions.
- ✓ Our aim is to have a reliable permanent communications link between the vehicle and the control room. Based on 5G Satellite.
- ✓ Our aim is to have a vehicle that knows for sure where it is located. Does not deviate from its route or lane. Based on GALILEO.
- ✓ **Safety and reliability is always paramount. Innovative technologies and risk management (HARA) will be deployed to support this.**

*In order to **guarantee maximum safety (and remain insured)**, we must be aware of the potential safety risks relating to the vehicle itself, human behavior, weather conditions and traffic situations.*

Specific conditions that form a risk require appropriate mitigation to reduce the risk to an acceptable level. We have identified and listed these specific conditions for situations in which a steward is present in the vehicle and have translated them into concrete terms. We will adjust this accordingly to drive without a steward.

➤ Hazard Analysis and Risk assessment (HARA)

HAZARDS	RISK ASSESSMENT	MITIGATIONS	RISK ASSESSMENT
Hazard scenario: if... then...	Risk	Actions taken (to reduce risk)	Risk

# Future challenges @ESA

- Further developing the concept together with all partners.
  - ✓ Operations,
  - ✓ Problem solving
  - ✓ Research
  - ✓ Monitoring
  - ✓ Infrastructure
- ESA ESTEC is the perfect site to take that step:
  - Support on innovative technology
    - Positioning (NAVISP)
    - Communications (5G)
- Ultimate goal is driving without a steward (=fully autonomous) by end of 2020!?
- The remotly monitored and controlled testvehicle will drive with passengers in 2021!



# NAVISP and the ESA Shuttle project

Under the support of NAVISP we aim to support driving automated at ESA without a steward:

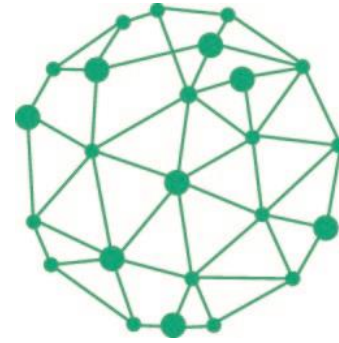
- The stewards in ORBITER are there to ensure the vehicle is actually located where the positioning software thinks it is. Currently a deviation of the positioning can not be limited to a guaranteed boundary.
- In HAWKING we want to be able to guarantee this boundary (both in theory and practise) to a certain extend ensuring HAWKING without a steward on board will remains on track at all times in both the physical world and on the Digital-map used by the vehicle. We will challenge the market and universities to deliver model calculations, technology and services, leading to a Proof of Concept and Final Implementation.

# 2020 Projectplanning with focus:

safe driving on-

## site, no steward in the vehicle

1. First Vehicle ORBITER: Is manned with stewards (Arriva) and circles the ESA campus according to service schedule, running on software 4.X.X
2. Second Vehicle HAWKING: A second on-site test vehicle to pilot enhancements (positioning, telecom) that support driving without a steward on Navya's Roadmap towards version 5.X FA. It will be using GALILEO for positioning, Connected using 5G-Satelite and monitored/controlled from a Control Room (SaaS).



Dutch  
Automated  
Mobility

AEBEL



arriva

**Thank you!**

